PROJECT NARRATIVE

1.0 INTRODUCTION

1.1 Site Description

Maunalua Bay, located in urban Southeast O‘ahu, spans from *Kawaihoa* to *Kupikipiki‘o* (also known as Koko Head Point to Black Point), includes nearly 8 miles of shoreline and 6.5 square miles of ocean waters (see Figure 1). The Bay at one time was extremely productive, with a well-known fishery that provided fish and invertebrates for local residents. Today, the Bay is home to 60,000 residents and is a popular site for recreational activities including fishing, boating, diving, para-sailing, jet-skiing, outrigger canoe paddling, and surfing. Maunalua Bay is well loved, but not well cared for.

Maunalua Bay is characterized by large reef flats extending well out from the shoreline to a fore reef that drops to about 15-20 feet. Beyond the fore reef the sea floor gradually increases in depth, broken up by small sudden drop offs. The broad reef flat is home to a diversity of many culturally important marine algae and fish. The fore reef is home to the greatest coral reef growth in the bay and harbors the greatest diversity of marine life in Maunalua. Surgeonfish, butterflyfish, parrotfish, goatfish, squid, eels, crabs, and many other animals rely on the corals for food and shelter. In addition, more recognizable and charismatic sea life like dolphins, turtles, rays, sharks, whales, and, occasionally, monk seals frequent the bay.

1.2 History of Maunalua Bay

Maunaulua Bay is a biological and cultural treasure of Hawai‘i, and has a special history of waters abundant with fish and coral, inland fishponds and farms, and people who lived off and cared for the lands and the waters. With its natural inlet, Maunalua was an ideal location for early settlements and was developed by ancient Hawaiians into a rich fishpond system. The great fishpond was one of O‘ahu’s largest. Other fishponds edged the shore at Paikō, Niu and Wailupe. The fishponds, deep water fisheries, streams and lands were carefully managed for sustainability by a *konohiki* (landlord) and supported a thriving pre-contact population.

This tradition of caring for and sustaining the place was carried into the early half of the 20th century. A fishing cooperative’s (1950s) regulations for our project site pointed to the former abundance of resources that is now sadly, severely depleted. The historical daily catch limits for any one member, his guests, and household were “*30 fish, 5 squid, 5 lobsters, and no limit on crab*”. As recent creel surveys clearly demonstrate, there would be no need to set such limits today.

1.3 Threats

The marine resources in Maunalua Bay have been steadily declining. The top threats responsible for this decline are believed to be overharvesting, habitat loss in nearshore areas, and sedimentation. What remains of the Bay’s resources are still very important both biologically

and socially. Regions of the Bay continue to harbor healthy coral reef, native sea grass beds, and a variety of reef vertebrates and invertebrates.

The biggest looming threat to these remaining resources is invasive alien algae (IAA). This project focuses on removing and controlling the invasive alga *Avrainvillea amadelpha,* which outgrows, outcompetes and smothers coral and seagrass, changing the nature of the substrate. *A. amadelpha* "generally grows on rock, coral rubble, or sandy reef flats, from the shallow subtidal to 80m. It is often found in almost monospecific beds, where it can displace all other species, including the endemic seagrass *Halophila hawaiiana."* (Huisman, et al. 2007)

A. amadelpha was first reported in Hawai'i by scientists in the early 1980s, and was perhaps accidentally introduced. To date, little scientific research has been conducted or documented on the life cycle and growth rate of this species. It has since spread along the southern shores of O'ahu. This invasive alga forms a canopy that covers the substrata that corals could settle on, creating an anoxic layer in the sand. The canopy provides an environment in which other invasive algae and invertebrate species grow. By removing *A. amadelpha*, we will remove other epiphytic invasive algae and invasive invertebrates, such as the introduced mantis shrimp, *Gonodactilaceus mutatus*.

Currently, *A. amadelpha* is found in at least 270 acres of coral reef habitat in Maunalua Bay (see Figure 2: Distribution map of *A. amadelpha* in Maunalua Bay). Fifty-four acres have thick densities, while the remaining areas have medium to light densities. Coral reefs and seagrass meadows, in particular, remain at risk from the spread of IAA from these sites. In the last three years, community volunteers have removed more than 18 tons of IAA. The cleared areas have remained clear and there is growing evidence of recolonization by native species, thus increasing biodiversity.

1.4 Strategies for Reef Restoration and Conservation

A Conservation Action Plan for Maunalua Bay has been guiding the work in the bay for the past three years. It has recently been updated, in consultation with The Nature Conservancy (TNC) and the National Oceanic and Atmospheric Administration (NOAA), but the main strategies for reef restoration remain the same. The three top strategies in Maunalua Bay are: 1) reducing land-based pollution through improved watershed management, 2) addressing the fisheries decline through strategic engagement of and outreach to fishers, and 3) IAA control. While this project focuses primarily on reducing the IAA threat, land-based and fisheries management strategies are currently being pursued by TNC and our government and community partners, thereby increasing the effectiveness and sustainability of this project.

2.0 PROJECT DESCRIPTION

The proposal is to remove 22 acres of *A. amadelpha* from the nearshore waters of Kuli`ou`ou. To date, approximately ¼ acre of *A. amadelpha* has been cleared from coral reef and seagrass habitat by community volunteers in Maunalua Bay. However, the area cleared represents only a small fraction of the total area currently overgrown with *A. amadelpha*. This proposed project would provide significant ecological benefits and transform the small-scale community removal

efforts underway into a large-scale removal model of *A. amadelpha* in Maunalua Bay. The project would allow communities to experience first-hand how their efforts can succeed at a larger and more biologically meaningful scale, while also employing Bay residents and engaging a larger proportion of businesses and families in stewardship of the Bay.

2.1 Scope and Approach

The scope of the proposed project would include both large- and small-scale removal efforts across Maunalua Bay. Specific, site-based, large scale removal would be focused on the reef flats and seagrass beds of Kuliʻouʻou. Smaller scale removal efforts would take place at four neighborhood community sites: (1) Hawaiʻi Kai, (2) Paikō Beach; (3) Wailupe Stream; and (4) Kawaikuʻi Beach Park (see Figures 1 & 2).

Job creation for both large- and small-scale IAA removal would be required to achieve the intended conservation impacts. While these IAA removal efforts would be the primary focus in the Bay, the project would take a balanced approach to achieving results. Field-based IAA removal efforts would be supported by a focused public education and outreach campaign by Malama Maunalua. Field-based IAA removal efforts would be complemented by both a focused public education and outreach campaign and the organizational capacity building of the lead community group, Mālama Maunalua to sustain IAA removal efforts at scale beyond the 18-month project timeframe (see Section 4).

As a complement to other government-led IAA removal efforts in Hawaiʻi, the project approach under this proposal would be community-based, with government support. TNC believes strongly that a bottom-up approach to address this threat is a necessary and useful complement to that of top-down initiatives. Through this project, we are proposing to not only leverage government funding and support, but also support existing community efforts to build a unique base of community interest, experiential learning, and site knowledge. A sustainable, strong and competent community organization will be essential to maintaining and extending that which is restored in this project. Therefore we have included strengthening the capacity of Mālama Maunalua, the proven community organization focused on conserving and restoring Maunalua Bay to work with us in this project. Through this confluence of top-down and bottom-up leveraging, the project would achieve a new scale of ecological, social and economic benefits.

2.2 Goals and Objectives

The proposed 24-month project has three distinct yet inter-dependent goals:
(1) To remove a significant section of the densest distribution areas of IAA in Maunalua Bay as a first, critical step toward ecological restoration of coral reef and seagrass beds;
(2) To create employment and stimulate emergent ‘blue-green’ enterprises on Oʻahu; and
(3) To build sufficient community capacity in the Bay that will result in expanded and sustained local reef management efforts. Each goal has an associated set of objectives.

Goal 1: Coral reef habitat restoration

Objective 1-1: To reclaim potential coral reef and seagrass habitat in Maunalua Bay by removing, within 18 months, at least 23 acres of *A. amadelpha* from substrate where native reef species can recruit, re-establish, and expand.

Objective 1-2: To encourage the expansion and re-colonization of endemic seagrass (*Halophila hawaiiana*) and native reef algae (e.g., *Dictyota*, *Padina, Spyridia, Gracilaria parvispora* and *Halimeda*) species at Kuli‘ou‘ou by 2012 through the re-connection of once fragmented suitable sandy and hard bottom habitat.

Objective 1-3: To expand coastal and marine habitat restoration efforts with communities one to six watershed units in Maunalua Bay.

Goal 2: Provide employment and stimulate ‘blue-green’ business during

Objective 2-1: To create jobs relating to coral reef habitat rehabilitation in Maunalua Bay during the 18-month project lifetime, including approximately 40 full-time and 20 part-time IAA removal and professional conservation positions. As opportunities arise, link this trained labor force with emergent initiatives under objective 2-2.

Objective 2-2: To stimulate entrepreneurship and market growth regarding potential investments in coastal and marine habitat restoration businesses operating in Hawai‘i by 2011.

Goal 3: Build community capacity for expanded and sustained management

Objective 3-1: To strengthen and expand the levels of public awareness, community involvement, and organizational ability necessary to sustain long-term local reef management efforts in Maunalua Bay by 2012.

Objective 3-2: To build the organizational capacity of MM to ensure its ability to serve long-term as the lead non-governmental organization focused on coastal and marine habitat restoration and coral reef management in Maunalua Bay.

A summary description of how these seven objectives would be implemented through relevant project activities is provided in Section 2.4.

2.3 Justification

With twenty five percent of Hawai‘i’s marine life found nowhere else, Hawai‘i’s nearshore waters have the highest levels of marine endemism of any place of similar size on earth. This project would support a process to clear IAA-encased coastal and marine habitat as a first, critical step to restoring coral reef and seagrass habitat in Maunalua Bay. Such efforts would benefit a wide range of coral reef associated species that once thrived in the Bay, including several endemic reef fish species, the rare and endemic Hawai‘i seagrass (*Halophila hawaiiana*), and several native reef algae species (e.g., *Dictyota*, *Padina, Spyridia,* and *Halimeda spp.*). These rehabilitation efforts would provide additional, critical habitat for marine biodiversity and foraging grounds for several threatened or endangered marine animals, most notably the green sea turtle.

This project proposes to scale-up IAA removal efforts in the Bay to a biologically meaningful level, building upon a solid foundation of knowledge from on-going community IAA removal efforts over the past three years. The site selection for the proposed large-scale IAA removal has

been carefully considered and thoroughly discussed by Maunalua stakeholder groups. The Kuli‘ou‘ou reef flats area (Figure 1) was chosen as the logical site for a large-scale IAA removal effort because: (a) the site has the highest concentration of *A. amadelpha* throughout its range within the Bay (see Figure 3); (b) the site has some of the healthiest, endemic seagrass meadows remaining in Maunalua Bay; (c) the Kuli‘ou‘ou-Paikō neighborhood includes some of the most aware and active residents in the Bay, the majority of the community IAA removal efforts to date have taken place here; (d) neighborhood residents are aware and in full support of this proposal (see neighborhood support letter in Appendix C); (e) in combination with this project, efforts by the U.S. Army Corps of Engineers to address upland land-based pollution issues in the Kuli‘ou‘ou watershed could serve as a model for *ahupua‘a* (ridge-to-reef) management practices in the State; and (f) there are complementary biological values of the site, including the presence of an adjacent native bird sanctuary and high freshwater flow from stream and groundwater sources which create habitat corridors for migrating native diadromous fish.

In terms of a rationale for the large-scale IAA removal proposed under this project, three economic valuation analyses were carried out by TNC staff to gauge the justification and appropriate scale for the proposed work: (1) a benefit-cost analysis, (2) a cost effectiveness analysis, and (3) an incremental cost analysis. These analyses focus on the feasibility and rationale for using a mix of small- and large-scale IAA removal efforts that employ low-tech removal methods at the proposed project site. Details on these analyses are presented in Appendix A. The main conclusions to be drawn from these three analyses are:

(1) Benefit-Cost Analysis: the proposed project is not only considered economically efficient, but the restored area of coral reef and seagrass habitat would also provide considerable economic returns to society through multiple uses (extractive and non-extractive) of restored habitat.
(2) Cost Effectiveness Analysis: a mix of 40 full-time and 20 part-time laborers over a 14-month IAA removal period would meet the necessary level of extractive output required to meet the project’s intended ecological restoration goals and objectives while minimizing total costs.
(3) Incremental Cost Analysis: an IAA removal labor force of 40 full-time and 20 part-time workers is the most efficient labor scenario given variable incremental cost adjustment.

These findings indicate not only that the optimal IAA removal labor scenario using the methods proposed (a mix of full- and part-time IAA extractive effort) is required at the project site, but also that such a labor mix may be a viable strategy at other IAA infested reef sites in Hawai‘i.

Finally, compared with other known habitat restoration efforts, the restoration cost of $407,923 per hectare for the proposed project would be ‘low’ to ‘moderate’ (Spurgeon, 1998). In contrast, the economic costs of inaction or no restoration are high. In Kīhei, Maui, the problem of *Hypnea* algal blooms was estimated to cost the state $20 million per year.

2.4 Implementation Strategy and Timeline

The project would commence on July 1, 2009 and end after 24 months, on June 30, 2011. Project monitoring efforts would commence during July 2009, and will continue throughout the

project. See the attached Gantt chart summarizing the timeline of various project activities, by proposed goal, and illustrating the proposed timing and workflow of all project activities throughout the proposed 24-month project timeline. The staggered timing and estimated duration of the proposed activity workflow has been designed to minimize risk and ensure timely attainment of correlated benchmarks. This will ensure smooth project execution and sustained project funding and continuation through time.

Under Goal 1, IAA removal activities during the project lifetime would be split between: (1) large-scale extraction of *A. amadelpha* over a 14-month period of August 1, 2009 through January 30, 2011 from at least 22 acres (representing up to 90% of estimated on-site biomass) of contiguous substrate; and (2) community volunteer extraction of at least 1 acre cumulatively from four community rehabilitation areas (i.e., one-quarter acre plots each) throughout the full, 24-month project timeline. It is recognized that these intended large-scale and community extraction targets may be achieved prior to the end of the full 18- and 24-month (respectively) proposed project timeframes, based on intended project progress time estimates. However, at a minimum a 24-month project timeline would allow for both additional project monitoring and performance evaluation time, and at best perhaps allow for expanded IAA extraction efforts beyond the intended project targets (if logistically and financially feasible). In total, at least 23 acres of IAA will be cleared and made available for native reef species expansion and recruitment during the project lifetime. High-resolution imagery of the actual distribution of *A. amadelpha* and other benthic species throughout the project area will be periodically collected during the 24-month timeline to validate total acreage cleared.

Estimates of the projected total monthly area cleared (see *Figure 4*) are based on removal rates as influenced by daily and seasonal tidal variation and the depth profile of the project site.

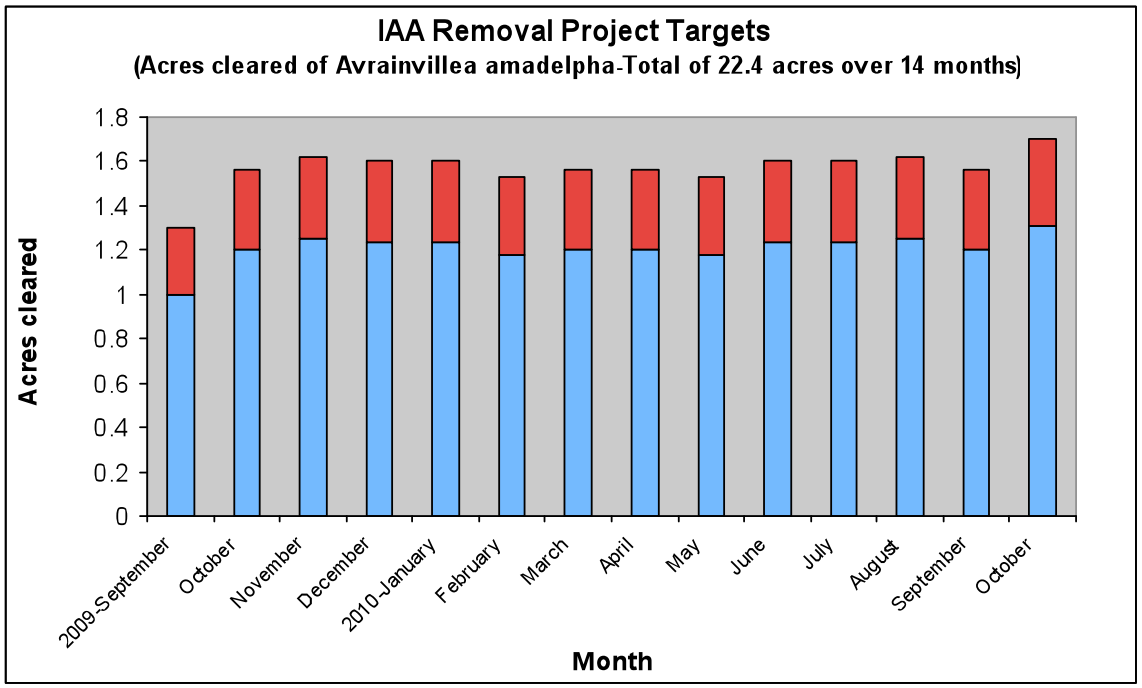

Figure 4. Estimated monthly calculations of the number of acres to be cleared of IAA during the proposed 14-month extraction period.

Fortunately, it has been demonstrated through monitoring efforts over the past several years at cleared sites that that once removed, *A. amadelpha* does not grow back quickly (Peyton, et al., 2006). Based on three years of experience, there is grounded expectation that native habitat restoration is feasible.

By the tenth month of IAA extraction, the project may have sufficient monitoring data to quantify the recovery rate of a cleared area of habitat and identify which species are recruiting onto cleared substrate. The project team would work with phycologists and scientific advisors to re-plant and encourage re-colonization of endemic seagrass (*Halophila hawaiiana*) and/or native reef algae (e.g., *Dictyota*, *Padina, Spyridia,* and *Halimeda*) in discrete test plots. Such activities would focus on reconnecting suitable sandy and hard bottom habitat, particularly within 'fringe' areas adjacent to existing seagrass beds within the project site.

Also related to Goal 1 would be project efforts designed to expand the spatial geographic extent of IAA removal by the project. During the first 10 months of the project, community participation in the project would be expanded to sites throughout Maunalua Bay (see Figure 1). This would be achieved through targeted volunteer recruitment as a component of a focused public outreach campaign relating to Goal 3 of the project.

We intend to build in representation from a majority of primary stakeholder groups, as identified by the project team. Increased stakeholder representation and participation will be used during the project lifetime to engage and educate Maunalua Bay community residents, and grow local support for sustained reef restoration efforts beyond the 24-month project timeframe.

Relating to Goal 2 activities, as outlined in Table 1, we expect that the project would directly create approximately 65 jobs and support 10.5 current jobs (total: 75.5 jobs) relating to reef habitat rehabilitation in Maunalua Bay during the 18-month project lifetime. New jobs will include approximately 40 full-time and 20 part-time IAA removal positions, and approximately 5 full-time professional conservation positions. These new jobs would be accessible to a wide cross-section of Hawai'i's diverse economic, socio-cultural and ethnic society. The proposed project would not only leverage four years of site-based IAA removal investment, experience, and learning, but also an estimated 15,000 hours of community and student volunteer services over the 18-month period, through IAA removal efforts at community sites and project team member contributions. This estimate is based on two years of documented community volunteer and in-kind staff time contribution calculations.

Table 1. A summary table of the jobs to be created under the project, by NAICS code.

Responsible Partner	*NAICS Code*	*# of people employed*	*Total Labor Hours 24 mos.*	*Position or Task (Part-Time or Full-Time)*	*Short Job Description*
TNC	813312 Environment, Conservation and Wildlife Organizations	5.0	992	GMT Project Manager, GMT Restoration Director, Regional Marine Director, Grants Specialist, Communications Specialist	Core project support and management
TNC	813312 Environment, Conservation and Wildlife Organizations	4.0	1,040	Project Manager, Community-Based Marine Program Coordinator, Phycologist, Senior Marine Scientist	On the ground implementation and project coordination and management.
Community Links Hawai‘i on behalf of Mālama Maunalua	813312 Environment, Conservation and Wildlife Organizations	1.0	3,000	Project Co-Manager	Coordinates day-to-day field operations of contractors and community volunteers.
Community Links Hawai‘i on behalf of Mālama Maunalua	813312 Environment, Conservation and Wildlife Organizations	3.3	7,410	Outreach Specialist, Community Organizer and Trainer, Volunteer Event/Survey Coordinator, Outrach/Communications contractor	Implements public information campaign; oversees outreach contracts and products; coordinates all public involvement.
Community Links Hawai‘i on behalf of Mālama Maunalua; and Research Scientists	813312 Environment, Conservation and Wildlife Organizations	2.2	2,870	2 Scientific Advisors, Data Manager/GIS Planner contractor, 2 Research Assistants	Technical guidance and monitoring support; data management plan and database development; data entry and analysis; applied scientific research.
CONTRACT	114119, Other Marine Fishing	20.0	20,000	Part-time unskilled labor	Alien algae removal and disposal
CONTRACT	114119, Other Marine Fishing	40.0	80,000	Full-time unskilled labor	Alien algae removal and disposal
CONTRACT	541712, Research and Development in the Physical, Engineering, and Life Sciences	3.0	240	Part-time, skilled labor	Investigating ecological impacts of IAA removal efforts on-site
CONTRACT	541370, Aerial surveying (except geophysical) services	2.5	80	Part-time, skilled labor	Aerial surveys over cleared areas and image analysis
TOTALS		81.0	115,632		

Also relating to Goal 2, we anticipate that the project would stimulate entrepreneurial investment interest in coastal and marine habitat restoration businesses operating out of Hawai‘i. Potential services include field-based alien species removal operations (including IAA), environmentally-friendly waste disposal of extracted IAA, value-added natural product development from

extracted IAA (e.g., agricultural and compost additives, natural paper products), and high-resolution submerged resource mapping services. By month five, the project would stimulate, and then gauge, interest with Hawai‘i-based “blue-green” entrepreneurs. During month 10, the project team would work with interested entrepreneurs to develop and explore viable business models to potentially service Maunalua Bay and other Main Hawaiian Island sites. Should a viable business model emerge by month 16, possible private investment avenues would be explored by interested entrepreneurs in collaboration with the project team. As opportunities arise, the project team will link such emergent initiatives with the newly trained labor force in order to promote wherever possible the perpetuation of the new jobs created by this project beyond the 18 month timeline.

Measurement of blue-green entrepreneurship spurred could be measured by:

-Number of jobs generated by this project (in addition to project staff)
-Value-added products that spin-off from this project.
-Number of inquiries from companies interested in providing services to this project

Relating to Goal 3 activities, immediately following the project start date the project team would begin strengthening and expanding public awareness of and community engagement in the project. A targeted campaign would commence during the second month, to build and maintain wide support for the project from the estimated 60,000 residents and 20,000 households surrounding the Bay. A variety of media sources and messages would be used to reach specific target audiences.

The first three months of the public outreach campaign would introduce the project, raise public awareness of the issues, and recruit community volunteers from various stakeholder groups. During the fourth month, the campaign would broaden to include project progress and impact. By the tenth month, monitoring results would be communicated widely. Public outreach efforts would result in increased local management capacity by strengthening and expanding the level of community interest, organizing effort, and action being taken locally to address threats facing coral reefs in the Bay.

As a critical component to the success of Goal 3, the project would build the organizational capacity of Mālama Maunalua so that it has sufficient administrative, technical, and community capacity long-term to serve as the lead non-governmental organization focused on coastal and marine habitat restoration and coral reef management in Maunalua Bay. The goal is to establish Mālama Maunalua as a legal entity, followed thereafter by an application with the IRS to receive 501(c)(3) status as a formal not-for-profit tax exempt entity. Organizational development during the project lifetime would also involve activities relating to formalization of a governance structure, board of trustees development, development of administrative policies and procedures, organizational strategic planning and adaptation, and fundraising planning and philanthropic outreach. As a result of these efforts, MM would be positioned to formally lead project efforts beyond the 24-month timeline. An end-of-project transition plan to do so would be created during month 16 and implemented following the close of the project.

Beyond sustaining restoration efforts in the Bay, successful community capacity building under Goal 3 of this project also will contribute to community management capacity at other

conservation sites in Hawai‘i through site-to-site transfer of technical skills, implementation knowledge, and application of lessons learned. The success of the proposed project will therefore lead to enhanced community management capacity throughout Hawai‘i, particularly through existing community management networks such as the Managing Better Together Network and the Locally-Managed Marine Area Network.

Following the conclusion of the 14-month large-scale IAA removal effort, field efforts during the last six months of the project (January 1 through June 30, 2011) will be focused primarily on: (1) project impact monitoring and analysis; and (2) completion of the public outreach campaign. The project would end after 24-months of implementation, on June 30, 2011. The macro-view timeline is as follows:

Start		**2009**				**2010**												**2011**					**End**
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun

The months in orange are the requisite preparatory months and post-extraction monitoring and project evaluation. The months in green represent the physical removal of the invasive alien algae. A more detailed Gantt chart showing activity timelines with milestones, benchmarks and anticipated outputs is shown in the pages below:

Table of Proposed Activities and Timeline

Proposed Activity (by Objective)	*2009*						*2010*												*2011*						*Benchmarks and Anticipated Outputs (per Activity)*
	Q1			*Q2*			*Q3*			*Q4*			*Q5*			*Q6*			*Q7*			*Q8*			
	J	*A*	*S*	*O*	*N*	*D*	*J*	*F*	*M*	*A*	*M*	*J*	*J*	*A*	*S*	*O*	*N*	*D*	*J*	*F*	*M*	*A*	*M*	*J*	
Objective 1-1: To reclaim coral reef and seagrass habitat in Maunalua Bay by removing at least 23 acres of *A. amadelpha* from substrate where native reef species can recruit, re-establish, and expand within 18 months.																									
Activity 1-1a: Contractor RFP design and advertisement by project advisory board																									RFP for contractor drafted; bids received and reviewed
Activity 1-1b: Contractor selected and contracted																									Contractor selected; Contract signed; Initial laborers hired
Activity 1-1c: Large-scale IAA extraction operations at project site																									At least 22 acres of IAA cleared
Activity 1-1d: Neighborhood-level IAA extraction organizing at 4 community sites																									Volunteer extraction teams organized in each neighborhood
Activity 1-1e: Small-scale IAA extraction operations at Paiko & Wailupe																									One-quarter acre of IAA cleared from each community extraction site
Activity 1-1f: Small-scale IAA extraction operations at Hawaii Kai & Kawaikui																									One-quarter acre of IAA cleared from each community extraction site
Activity 1-1g: Extraction project impact monitoring and analysis																									Project course-corrections and adaptation completed, as needed
Activity 1-1h: Post-extraction of large-scale removal impact monitoring & analysis																									Impact of cumulative IAA extraction efforts documented
Objective 1-2: To encourage the expansion and re-colonization of endemic seagrass (*Halophila hawaiiana*) and native reef algae (e.g., *Dictyota*, *Padina, Spyridia,* and *Halimeda*) species at Kuli‘ou‘ou by 2012 through the re-connection of once fragmented suitable sandy and hard bottom habitat.																									
Activity 1-2a: Identify test plots on reef for active re-colonization efforts																									Plot test areas identified and delineated
Activity 1-2b: Re-colonize native species actively within test plots																									Native organisms re-introduced into cleared areas of reef
Activity 1-2c: Monitor re-established organisms and compare to control plots																									Comparison between active re-colonization vs. natural recruitment done.
Activity 1-2d: Monitor natural re-growth rates of IAA into cleared areas.																									Re-growth rate of IAA into cleared area documents; re-growth prevented
Activity 1-2e: Monitor edge effects along fragmented habitat units before and after re-connection																									Changes in community structured documented through habitat unit re-connection; edge effects of fragmented habitat investigated
Objective 1-3: To expand coastal and marine habitat restoration efforts with communities from one to six of the 10 watershed units in Maunalua Bay.																									Increased public participation and representation within watershed units of Bay.
Objective 2-1: To create jobs relating to coral reef habitat rehabilitation in Maunalua Bay during the 18-month project lifetime, including approximately 40 full-time and 20 part-time IAA removal and professional conservation positions.																									
Activity 2-1a: 40 full-time & 20 part-time laborers hired and working																									60 jobs created. Hires completed.

Proposed Activity (by Objective)	2009						2010												2011						Benchmarks and Anticipated Outputs (per Activity)
	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	
Activity 2-1b: 1 new TNC project manager hired and working																									1 job created. Hires completed.
Activity 2-1c: 3 FTE-equivalent new MM positions hired/contracted and working																									3 FTE equivalent jobs created. Hires completed.
Activity 2-1d: Socioeconomic monitoring of project impacts underway																									Socioeconomic impact of project documented.
Activity 2-1e: Community volunteers provide in-kind labor on project																									At least 15,000 hours of community and student volunteer time contributed
Objective 2-2: To stimulate entrepreneurship and market growth regarding potential investments in coastal and marine habitat restoration businesses operating in Hawai'i by 2011.																									
Activity 2-2a: Entrepreneurial working group established by project																									Working group established representing diverse business interests
Activity 2-2b: Stimulate private interest in Hawaii-based "blue-green" IAA efforts																									Potential sources of private investment identified
Activity 2-2c: Develop and explore viable business models for IAA removal																									Business plan developed and reviewed by potential investors
Activity 2-2d: Pursue potential viable business model with investor(s)																									New IAA business established privately in Hawaii (potential)
Objective 3-1: To strengthen and expand the levels of public awareness, community involvement, and organizational ability necessary to sustain long-term local reef management efforts in Maunalua Bay by 2012.																									
Activity 3-1a: Neighborhood community outreach to recruit local volunteers																									Volunteers recruited and trained
Activity 3-1b: Public outreach campaign conducted																									Public awareness raised; increased public attention, support, and action
Activity 3-1c: Socioeconomic monitoring regarding changes in awareness done																									Changes in public awareness and level of understanding documented
Activity 3-1d: Targeted media sources communicate messages regarding project																									Various media products generated on project
Objective 3-2: To build the organizational capacity of MM to ensure its ability to serve long-term as the lead non-governmental organization focused on coastal and marine habitat restoration and coral reef management in Maunalua Bay.																									
Activity 3-2a: Malama Maunalua (MM) starts pursuit of legal entity.																									
Activity 3-2b: MM formalizes governance structure & board of trustees																									MM governance becomes operational Not-for-profit exempt status granted by IRS.
Activity 3-2c: MM board passes by-laws, policies & procedures, strategic plan																									
Activity 3-2d: MM is established as a 501(c)(3) organization.																									MM fully operational and compliant not-for-profit organization Legal entity established.
Activity 3-2e: MM creates end-of-project transition plan with TNC																									IAA removal efforts sustained by MM following end of project
Activity 3-2f: Fundraising commenced for MM to sustain project efforts																									Financing for sustained IAA removal efforts in place by project

Proposed Activity (by Objective)	2009						2010												2011						Benchmarks and Anticipated Outputs (per Activity)
	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	
																									end
Process Objective 1: To monitor and periodically evaluate project performance.																									
Activity P-1a: Convene monthly Project Advisory Board meetings																									Monthly activity implementation progress assessed; needed adjustments made to project performance.
Activity P-1b: Conduct 'mid-term' project evaluation																									Evaluation results presented to Project Advisory Board; adaptive actions taken to project performance, as necessary.
Activity P-1c: Conduct end-of-project evaluation																									Evaluation results submitted with final report to NOAA and shared with potential private investors in post-project efforts to sustain IAA removal.
Activity P-1d: Provide biological and socioeconomic monitoring updates within quarterly reporting to NOAA.																									Reporting provided.
Process Objective 2: To increase the scientific understanding of IAA removal efforts																									
Activity P-2a: Applied research questions identified by science advisory board																									Research questions identified.
Activity P-2b: Contractor RFP design and advertisement by science advisory team																									RFP for contractor drafted; bids received and reviewed
Activity P-2c: Applied science contractor selected and contracted																									Contractor selected; Contract signed; Initial laborers hired
Activity P-2d: Applied research studies conducted by contractor																									Research questions addressed through applied studies
Activity P-2e: Applied research studies provided to science advisory board																									Study findings reports provide to and reviewed by Project Advisory Board
Activity P-2f: Project activity adjustment based on applied research findings																									Adaptive adjustments made to project activities, as needed
Process Objective 3: Timely NOAA reporting																									
Activity P-3a: Provide quarterly reports to NOAA.																									Reporting provided.
Activity P-3b: Provide standard semi-annual reports to NOAA.																									Reporting provided.
Activity P-3c: Provide final annual report to NOAA.																									Reporting provided.

NOAA Stimulus Central Support & Outreach Team

PI = Program Integrator; RPD = Restoration Program Director; REG = Regional Marine Directors; GMS = Grants Mgmt; LEG = Legal; MRC = Marketing Resource Center

	2009		2010				2011				2012	
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
CENTRAL TEAM TASKS	**Jul-Sep 2009**	**Oct-Dec 2009**	**Jan-Mar 2010**	**Apr-Jun 2010**	**Jul-Sep 2010**	**Oct-Dec 2010**	**Jan-Mar 2011**	**Apr-Jun 2011**	**Jul-Sep 2011**	**Oct-Dec 2011**	**Jan-Mar 2012**	**Apr-Jun 2012**
Assistance with Project Staff Recruitment and Hiring *(PI, RPD, REG)*												
Assistance with RFPs and Bid Review/Contractor Selection *(PI, RPD, REG, LEG)*												
Project Fact Sheets and Web Materials Produced *(PI, RD, MRC)*												
Review and Assistance with Quarterly Reports (PI, RPD, REG, LEG, GMS)												
Project Fact Sheets and Web Materials Updated *(PI, RPD, MRC)*												
Site Visits (Subject to revision based on Project Milestones) *(PI, RD, REG)*												
Conference Calls & Web Presentations on Lessons Learned and Best Practices for Project Implementation and Monitoring *(PI, RPD)*												
Targeted Outreach for Major Media Market Coverage *(PI, RPD, MRC)*												
Synthesis document highlighting Project Outcomes *(PI, RPD, REG)*												
Presentations of Results at Conferences *(PI, RPD, REG)*												
Review and Assistance with Annual / Final Reports *(PI, RPD, REG, LEG, GMS)*												

2.5 Capacity Building for Local Resource Management

Goal: A strong and sustainable Mālama Maunalua; a nonprofit entity capable of engaging the community, guiding large restoration project initiatives, and effective grant-writing.

One of the most lasting, tangible results from this project is the strengthening of our project partner implementer, Mālama Maunalua. The following reasons are submitted as justification of this key project component.

This 24 month project to remove invasive alien algae is an essential step to the restoration of Maunalua Bay, but it is only the first step. Invasive species is only one of multiple factors that contribute to reef degradation. Land-based pollution, unsustainable resource harvesting and climate change are among the others, and all can play a role simultaneously, making management a complex, long-term proposition. It will take years of consistent, sustained, continuous terrestrial and marine projects to restore and then maintain this scarce environmental and cultural resource. To accomplish and sustain the long-term conservation objectives for Maunalua Bay requires a community-based organization to:

- provide continuous and consistent presence with the community, agencies, NGOs, regulators and legislators and provide a consistent community voice on key policy and regulatory actions require to restore and conserve Maunalua Bay;
- continue to reach, educate and involve the 60,000 residents in the region in planned and effective conservation actions;
- maintain sufficient staff to continue to build and implement the conservation projects;
- continue to partner with agencies and scientists and to enlist and support scientific research focused on the Bay.

In the three years since its inception, Malama Maunalua has been performing these critical functions. The organization has forged partnerships with key federal and state agencies, community organizations, business leaders, and NGOs, including TNCH. It has developed a comprehensive approach to Bay conservation and restoration. It has planted the vision that conservation can happen in an urban watershed. It is ideally and uniquely positioned to partner with TNC during this project, especially in the community building part, and to continue working with its partners at the end of this project. (It was through the partnership of MM & TNCH that the seriousness of the degradation of the Bay and the extent to which IAA has taken over the reefs was recognized, and MM's support of IAA removal has established the foundation for this project.)

Throughout the Pacific, it has been repeatedly demonstrated that marine conservation only works if it enjoys community support. It is the specific mission of MM to ensure community *kuleana* (stewardship/responsibility).

Long after this project ends, it will be Mālama Maunalua and the local residents who will ensure that the multiple projects are implemented and that hard-earned restoration gains endure. Thus it is critical to build the organizational capacity of Mālama Maunalua to ensure its ability to serve long-term as the lead non-governmental organization focused on coastal and marine habitat restoration and coral reef management in Maunalua Bay.

As a critical component to the success of Goal 3, the project would build the organizational capacity of Malama Maunalua so that it has sufficient administrative, technical, and community capacity long-term to serve as the lead non-governmental organization focused on coastal and marine habitat restoration and coral reef management in Maunalua Bay. During the first few months of the project, Mālama Maunalua would be established as a legal entity, followed thereafter by an application with the IRS to receive 501(c)(3) status as a formal not-for-profit organization. Organizational development during the project lifetime would also involve activities relating to formalization of a governance structure, board of trustees development, development of administrative policies and procedures, organizational strategic planning and adaptation, and fundraising planning and philanthropic outreach. As a result of these organizational capacity building efforts, by the end of the project Malama Maunalua would be positioned to formally lead on sustaining project efforts beyond the 24-month timeline. An end-of-project transition plan to do so would be created during month 16 and implemented following the project close.

Successful community capacity building under Goal 3 of this project would not only enhance the existing social networks and relationships that will be required to ensure long-term sustainability of management efforts in the Bay, but also will serve to contribute to and build the community management capacity at other conservation sites in Hawaii through site-to-site transfer of technical skills, project implementation knowledge, and application of lessons learned. The success of the proposed project will therefore lead to enhanced community management capacity throughout Hawaii and the Pacific Islands region, particularly through existing community management networks.

Organizational Outcomes include:

- Achievement of Independent 501(c)(3) status by 2011. Progress will be measured by tracking milestones along the way to achieving 501(c)(3) status--(i.e. board development, governance structure, bylaws, 501(c)(3) designation).
- Increases in # of on-the-ground projects Mālama Maunalua has operating.

Community Stewardship Outcomes Include

- Increased capability to reach out to key stakeholder groups across the region
- Number of volunteers engaged.
- Number of volunteer hours donated to Mālama Maunalua for invasive species management and monitoring.

Community Partnership Model Outcomes Include

- Increase in number of involved businesses committed to restoring Maunalua Bay and its watersheds in 2009 and continue to increase thereafter.
- Expanded partnerships with NGOs, neighborhood groups and government agencies required to regulate fishing and harvesting, control run-off and sediment and remediate serious sedimentation in the Bay.
- Model and support for other community-based marine management efforts

2.6 Implementation Team and Structure

The proposed Project Manager (TNC staff) would serve as the lead point-of-contact on the project, lead implementation, and have ultimate responsibility for managing all aspects of the project and all work and outputs from the team. This person would work in consultation and coordination with the proposed Co-Manager (MM staff), who would coordinate the day-to-day implementation of field activities and support the TNC Project Manager and contractor efforts.

The Project Manager and Co-Manager would consult with and be supported by an Advisory Board. Along with the Project Manager and Co-Manager, the Advisory Board would include two executive-level members each from TNC and MM, two community residents from the project site, one representative from the federal government (i.e., NOAA NMFS), and one representative from a Scientific Advisory Team (see below). The Board would meet at least monthly throughout the project to review and discuss project progress, and provide guidance on implementation activities and processes.

A Scientific Advisory Team would also be created to provide technical advice to the Project Manager, and offer scientific expertise regarding project field operations, including contributing at certain times toward impact monitoring efforts (See Section 5) and measuring IAA removal effectiveness. Along with the Project Manager, the Scientific Advisory Team would be comprised of two TNC scientists, a representative from MM, two researchers from academia, and one independent researcher.

This structure would promote effective collaboration and communication among the project team members, contractors, and community representatives and heighten the visibility of the project within the community. Also, it would ensure sufficient administrative and technical support and guidance to the Project Manager and Co-Manager so that the project remains on-budget, on-schedule, and fully accountable to participating organizations, interest groups, elected officials and decision-makers, and the American public.

3.0 METHODS

3.1 Large-Scale IAA Removal

The IAA will be removed by hand. We have tried mechanical means, but due to the shallow depths and the strong holdfast of *Avrainvillea*, manual removal is the safest and most effective method. The projections of area cleared are based on empirical extraction data compiled from our pilot project of community cleanup events. Removal operations are tide dependent and a low to rising tide is the most efficient work time. The projected extraction rates of approximately 1.5 acres per month takes into account efficiency variations associated with tidal fluctuations through 2010. Removal efforts will start in the thickest areas and then advance to the healthier habitat margins. A higher level of care will be needed in the margins to distinguish the IAA from native algae. Removal will be by two contracted labor crews of 30 each, working in the water between 3-5 hours a day, five days a week. A grid will be overlaid on the project site map and removal crews will work in 10m x 10m squares, working in a line downstream of the current so as not to disturb visibility, pulling the IAA by hand. Transferring the IAA to shore and then to the disposal site will be done by the hired crews using methods that will minimize disruption to the ecosystem as well as to the neighborhoods The initial plan is to transfer the IAA by way of shallow skiffs, then to transfer to temporary holding containers and then away from the property. The contractor will be responsible for developing a system, to increase efficiency over time. Removal of IAA from reef flats at this scale has not occurred before in Hawaii, and one anticipated product of this project will be refinement of removal and disposal methods.

Significant and consistent funding support from programs such as NOAA’s Community Restoration Program has enabled TNC and our partners to expand and innovate IAA control efforts in Hawai‘i. For example, a few years ago TNC, the University of Hawai‘i, and the State Division of Aquatic Resources created the Super Sucker, an underwater vacuum staged on a shallow draft barge that removes invasive algae off the reef at a much greater speed than can be accomplished manually, and at depth ranges out of the reach of community volunteers. Unfortunately because of its size, the Super Sucker technology does not function as well in shallow, intertidal reef flat areas, such as the majority of the habitat characterized within the project site area. Testing with smaller, Super Sucker “junior” and “mini” models in Maunalua Bay over the past few years has yielded promising, but occasionally problematic, results.

3.2 Community IAA Removal

Concurrent to the removal by the contracted labor crews, there will be community removal efforts at four sites in different neighborhoods across the Bay: Hawai‘i Kai, Wailupe Stream, Kawaiku‘i Beach Park, and Paikō Beach. Previous experience with these community-led IAA cleanups shows that a target of one-quarter acre area per community group per year is the appropriate scale. Project staff would support the logistics of these community-based IAA removal events. These volunteers will be targeted to champion some of the education and outreach goals in their neighborhoods.

The community’s desire to scale up their efforts is the impetus for this proposal. To date, more than 25 tons of IAA have been removed and the volunteers have made steady efficiency gains in their extraction rates. To shorten the learning curve for the newly hired crews, community members will be trainers of proper removal techniques and share other best practices gleaned from years of IAA removal. This transfer of knowledge will be key in making the hired workers feel part of the broader community effort.

3.3 Socio-economic Feasibility

Because of the relatively simple nature of the proposed labor required (IAA extraction by hand), such ‘low-tech’ jobs without skill requirement qualifications would be accessible by anyone who is in good physical health and is willing and interested in performing outdoor labor in the natural environment. With TNC’s water safety manual adapted for project use, and the necessary in-water safety equipment (e.g., wetsuit, padded booties, sun hat, hydration) provided to laborers by the contractor, the new jobs will be safe, technically feasible, and logistically simple. The people of Hawai‘i have a long history and deep cultural identity with land and sea stewardship. The

proposed jobs would be seen as positive contributions to the existing labor workforce and model examples of sustainable jobs that are accessible to anyone. Furthermore, monitoring and evaluating the economic value and impact of such jobs would be a relatively simple process for the project team (see sections 5.3 and 5.4). Finally, the technical simplicity of this project would be easily replicated at other communities facing similar IAA threats.

3.4 Disposal

3.5 Disposal Plan

The total estimated material to haul and dispose is 2,200 tons of IAA and associated sediment over the 18-month removal period. It is anticipated that a crew of 60 will be able to clear one acre in 20 days, for an average yield of approximately 100 tons per acre.

A flexible disposal plan is envisioned as follows:

The staging area will be by the Boat Ramp, where a large-volume container (20 cubic yards, with lockable lids) will receive extracted material, and subsequently be hauled away, emptied, and returned. The frequency of dump container removal and emptying will depend upon on the daily rate of extraction. This rate will be calculated and monitored through the project lifetime, in order to provide a more accurate estimate of daily and weekly average disposal requirements. Such information will be critical to monitor and better understand if investors are to consider how to privatize the algae extraction model as a private business following the completion of the project. Based on the project team's existing field data and current understanding, an estimated 157 tons of extracted algae per month (or 7.85 tons per day) can be expected as an average material flow from the proposed project. 1 ton of wet algae has the volume of approximately 1.87 cubic yards (1.43 cubic meters). The calculations that follow are based upon these estimates and assumptions.

For the first 6 months, 90% of the removed algae (approximately 141 tons/mo) will go to three identified disposal (land fill) and compost sites that are located in upland, non-flood areas. Private land owners assisting with this project include two farmers (Kalihi Nature Center and Nii Nursery) and one family, which will each take a portion of the removed invasive alien algae. Nearly all of the remaining 10% will go to two research sites that will investigate green composting and recycling technologies (16 tons/mo). Less than 1% of the removed algae will be held for exploratory, value-added product development design and testing. Directions for exploration of value-added product development will be informed by the project's green entrepreneurial committee, and will include communication with and invited product testing by private companies specializing value-added, environmentally-friendly goods and services.

The two farms are already receiving the IAA from community cleanup events and they have been composting and incorporating this mulch into the soil. The project managers will continue to work with these farms (and others, as volunteered) to evaluate the decomposition rate, reported utility/value, optimal mixing/contribution volume within soil/compost, and level of satisfaction of reported by farms regarding incorporation of extracted algae into mulched soil.

After 6 months, the various contributions and uses of this proposed disposal allocation system will be evaluated for possible improvements, incorporating feedback from the recipients of the IAA, removal and disposal contractors, and the science advisory team. If composting utility on farms is reported to be high, communication of results may be followed by invitation of additional, volunteer farms in order to increase disposal contributions of extracted limu into mulched soil, as opposed to conventional waste disposal methods (e.g., land fill).

We anticipate that as this project pulls out more IAA, new alternative and environmentally friendly methods of disposal such as composting for soil conditioner, and other value-added products made from this IAA will be developed. Contractors will be encouraged to find more efficient and economical methods of disposal, in the hopes that these can be adaptively as the IAA removal project advances. Based on these findings, the percentage of IAA stream going to the 3 bulk compost sites may be reduced and an increased amount apportioned to new and innovative uses.

Preliminary discussions with potential companies interested in competing for the removal and disposal RFP contract under this proposed award indicate that there is established, licensed, and complete on-island capability and expertise for the hauling and disposal of large volumes of material. While letters of interest were not invited by all of these companies, one letter of interest/intent from Hawaiian Steam Inc. has been included within this proposal (see page 11 of Supplemental Information) illustrating the relative "straightforward" nature of the proposed extraction and disposal approach being proposed. The project partners are optimistic that should the proposal receive funding, there will be significant competition by a number of private contractors to successfully secure the proposed extraction and removal contract, both because of the economic and community value in participating in such a habitat restoration project.

Throughout the life of the project, if any serious, persistent health or safety issues arise, or the recipient sites lack capacity to handle the volume received, the green waste stream will be temporarily diverted to landfill until new sites are available and/or conditions become suitable for continued composting and/or recycling at existing sites.

3.6 Mitigation Plan

The successful company contracted for the removal and disposal labor will be actively engaged by the project team and held responsible to following the project's IAA dispersal mitigation plan, This mitigation plan will be designed by the Science Advisory Team for the project to ensure that removal work does not create unintended, adverse side effects, particularly regarding the spread of invasive IAA species into non-contaminated areas (including cleared habitat).

Strategies that could be employed under this mitigation plan include:

1) Employing a boom system of curtain nets or geotextile screens and the spot use of dip nets, as needed, to contain IAA fragments freed into the water column during the removal process (this component included in budget), thereby preventing them from migrating onto cleared areas of reef.

2) Ensuring workers are well equipped and trained in containment and anti-contamination techniques, e.g. use of nets, safe loading and unloading methods, good tie-down methods, sanitation of wetsuits and booties after each use, configuration of workers upstream of the current so as not to disturb visibility, issuance of multiple sets of protective wear that can be rotated by the worker through a cleaning system.

3) Employing a 90% removal target. Ensuring workers are well trained to remove IAA to this degree. Mobilize volunteer community teams to glean any remaining fragments as needed.

4) Monitoring levels of toxicants in entrapped land-based sediment. While we do not anticipate findings of hazardous levels of toxicants, the mitigation plan will address alternative removal strategies in the event such conditions are identified.

An initial sample of *A.amadelpha* and its associated sediments from the project site is currently being analyzed by Dr. Ted Radovich at the University of Hawaii's College of Tropical Agriculture and Human Resources (CTAHR) laboratory. Once we receive the results in June, we will have a clearer idea of what mitigation measures to take.

3.7 Safety Plan

TNC has a comprehensive Field Safety Manual (attached) for the Hawaii Chapter, which guides all our field operations. In addition to this, a specific emergency plan will be used for the shallow water conditions and unique hazards to the IAA removal work. We will provide training to all project staff on how to avoid and provide First Aid for Hazardous Marine Life Injuries. Specifically, we will ensure that all employees have basic life support training and knowledge and skills in treating for envenomations, bites and irritations, and wound management at the project site. First Aid kits will be on-site and there will be an established emergency protocol.

In our field experience thus far, we have been very fortunate to not have had an accident. This is attributable to the culture of safety as well as the low probability, especially in shallow water, of serious injuries. This said, the threats of injuries are very real and by having a large crew,

probabilities are likely to increase. As with any outdoor work, some minor cuts, bruises and abrasions are bound to happen. We will do our best to train the crews in accident prevention and prepare them to handle emergency situations.

3.8 Transportation

The removal effort is tide dependent, and involves activities in a shallow reef environment. During the proposal design and initial writing process, the project team researched different alternatives of using boats, rafts, barges, and shallow-water skiffs with respect to mechanized transportation options for removed IAA transport from extraction site to shore for disposal. As a component of this investigation, the project team considered associated tie-down technology and transport feasibility and safety issues. During this process, the project team researched the feasibility of using various types of large-scale barge and vessel operations, including the use of open-ocean barges to hold and then transport extracted IAA to either a land-based stockpile site via container storage, or to a deep-sea disposal location within federal waters. The project team initially assumed that such large-scale sea operations would be the most efficient and cost-effective means of transportation of extracted IAA. As part of this investigation, the project team contacted relevant companies and federal authorities to discuss such marine transportation options. After the necessary information had been gathered, the project team met to discuss and evaluate their findings regarding such options. In the end, the project team determined that none of these large-scale options were deemed promising in terms of cost effectiveness, safety, permit feasibility within the specified timeframe, or environmental health.

In lieu of such large-scale transportation solutions, it became evident that several small-scale transportation alternatives represented the most promising transportation methods. In summary, a mix of low-cost, low-tech, and logistically-simple transportation methods would be employed, dependent upon the tide and depth of extraction site. When IAA removal efforts occur within areas of sufficient depth and tidal variation, extracted IAA will be loaded by hand onto shallow-water, pontoon-type skiffs furnished with a small outboard engine provided by the contractor. Based on the project labor and extraction rates, on ideal tides there will need to be at least three or four such skiffs, one for each extraction crew actively loading IAA, and one or two in transition to and from the staging area where transfer into dump containers will occur. Shallow-water flats boat technology currently allows for keel draw depths of less than 12 inches (loaded). The project will conservatively estimate that transport skiffs would need a minimum tidal depth of at least 15 inches to clear the shallow reef. As a result, the timing for transport of extracted IAA to the staging area will also be tide-dependent, as determined a week prior by the contractor and reviewed and approved by the Project Co-Managers. Once at the staging area, the material will need to be transferred into dump containers. This operation will be done by the hired crews. The contractor will be responsible for developing an appropriately feasible and efficient transfer system. Based on preliminary discussions with interested and potential competitive contract applicants such transfer systems might possibly involve conveyer belts or mini-excavators on shore, to increase loading/unloading efficiency over time.

During low tide and/or within shallow water habitat of less than 15 inches, skiffs will not be feasible. A flotilla of small rafts or pontoons that draw very shallow (i.e., a few inches depth) would be used to shuttle extracted IAA out to depths sufficient for loading onto the skiffs or to be towed boats through the deeper, established navigation lanes in the bay. From there, extracted IAA would be transferred to the boat ramp staging area, as described above. In some cases (for example, on a rising tide) extracted IAA may be simply held on such floating platforms at the extraction site until the tide rises enough to bring in the skiffs for loading and transfer to shore.

Due to tidal fluctuations, each month will have varying removal yields. Estimated removal efficiency of the operations will be tide dependent and we therefore have to be flexible in terms of working with the tides for both safety and maximum efficiency. Initial and rough modeling of our removal efficiencyiy in terms of days per month that are ideal and less than ideal (100%, 75% and 66% efficiency) based on tide charts are shown in Figure 5 below.

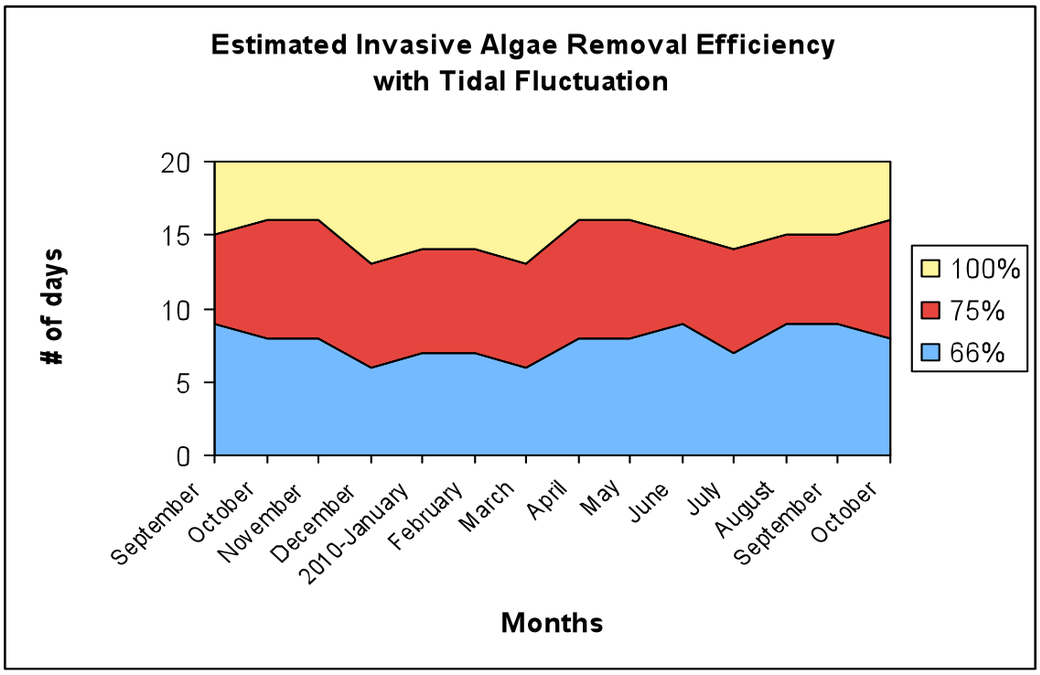

Figure 5. Estimated algae removal efficiency (# of days at 100%, 75&, 66%) based on tidal fluctuations during the proposed 14-month extraction period.

Because the project site occurs within the Bay and behind the barrier reef, wave turbulence is minimal to negligible, thereby allowing for the feasibility of the proposed transport methods without fear of transport vessel capsizing or accidental release of cargo (extracted IAA). In short, the sheltered, calm waters of Maunalua Bay at the project site provide for an ideal scenario to deploy the proposed transportation methodology.

3.9 Public Education and Outreach

The outreach methods used will be tailored to the target groups. The most directly affected residents will be addressed via small neighborhood gatherings. We will develop information flyers to take door to door for major project updates that affect these residents. We will equip Makai Watch and the volunteer removal teams to communicate with nearshore neighbors and bay users. A project concern phone line will also be established and the MM website updated to post status reports and handle inquiries.

It will take a broad-based public information campaign to keep the community aware of the necessity of the algae removal project, the extensive planning involved, safety issues, and effectiveness of the project methods and number of jobs created. We will provide information to multiple constituencies, through neighborhood board and community association meetings and track community reaction. We will have an "issue management" plan to deal with any project issues or public concerns, and develop a "Facts and Questions" piece to be used by the project team and with the media for consistent, accurate and effective communication.

We will also use web-based broadcast messages, direct mail, restoration demonstrations (at the volunteer sites), fact sheets and spokespeople to disseminate information at community events. Since approximately 35% of the households in the region have children in the schools, we would engage students and parents in stewardship activities through MM's existing partnership with NOAA's Navigating Change Program. MM will use a non-match contribution of $15,000 of advertising to place notices in the Honolulu Advertiser. We will develop signage and posters, as requested by fishermen, and post these at popular access points to clearly communicate marine and fishing regulations and penalties.

3.10 Permits

We hold current permits to conduct alien algae removal, issued by the State's Division of Aquatic Resources for activities through July 2009. Renewal of these permits in time for project implementation will be facilitated by the same office (attached letter of support). As an update, we have submitted a renewal application for our current collection permit to the State of Hawaii's Department of Land and Natural Resources (DLNR) and we anticipate that we will receive this renewal by the end of June. The Chairperson of the DLNR supports this project and has expressed her support through the attached letter.

4.0 PROJECT COLLABORATION

To achieve effective, on-the-ground conservation work in Maunalua Bay, we need reliable collaborators who live and work in the community to help lead conservation. MM and TNC are working side by side to bring back the health of the Bay. MM's mission, "*to conserve and restore a healthy and productive Maunalua Bay through community kuleana (responsibility)"* is clearly aligned with TNC's biodiversity conservation mission, and we each bring unique strengths into this partnership.

Since MM's inception, more than 5,000 community members have come out to learn and to help in restoration efforts and more than $250,000 has been contributed. The organization has been awarded several agency grants and recognized for their community-based conservation work. It has a highly qualified, full-time salaried coordinator, who will have significant involvement in the Kuli'ou'ou project. MM also has a full-time Volunteer/Outreach Coordinator who will be part of this project. MM has a strong steering committee composed of community members with specific business and professional expertise. Representatives of key agencies and NGOs act as advisors on the Steering Committee. MM has a strong fiscal sponsor, the non-profit Community Links Hawai'i.

4.1 Overall Qualification of Applicant

The Nature Conservancy has been working in Hawai'i for more than 25 years, beginning with a program to protect the state's biologically-rich native forests. We directly manage a statewide network of 11 private nature preserves totaling 40,000 acres, and are leveraging our work with partners in nine watershed partnerships to protect nearly a million acres of forested lands across the state. In 2002, we launched a marine program that has since helped protect nearshore waters in six coastal communities on three islands and helped pass strong new regulations limiting the use of destructive lay gill nets through an innovative social marketing campaign called Fair Catch. TNC Hawai'i's efforts to identify and begin addressing IAA began shortly after the marine program's launch. With our partners, we have become the leading force in managing IAA through mechanical and community-based removal efforts. These events have brought both state-wide attention and local action on the issue, and have helped raise awareness about the threats that alien algae pose to Hawai'i's coral reef systems.

Our collaborating organization, Mālama Maunalua has an established and effective organizational structure. It has a highly qualified professional as a full-time salaried coordinator, someone who is credible with government agencies and provides a consistent voice to and for the community. This coordinator will have significant involvement in the Paiko project. Malama Maunalua also has a full-time Volunteer/Outreach Coordinator and an Invasive Alien Algae Removal education specialist, both of whom will have significant involvement in the Community Education and Outreach component of this project. Mālama Maunalua has a strong steering committee bringing both expertise and community representation. Representatives of key agencies and NGOs act as advisors on the Steering Committee. In addition to the steering committee, Malama Maunalua has a very active Operating Committee, Finance Committee and Fundraising Committee, composed of community individuals who bring specific professional, management, and financial expertise to the organization. And it has a strong fiscal sponsor, non-profit Community Links Hawaii. Malama Maunalua's actions are guided by a rigorous Conservation Action Plan, developed in partnership with TNC and NOAA . The Operating Committee oversees activities through weekly operational meetings, monthly financial reviews,

quarterly plan reviews and an annual audit. The Operating Committee has developed expense policies and reviews grant proposals.

As stated earlier, Malama Maunalua is the model for effective community-based partnerships. In addition to The Nature Conservancy Hawaii, Malama Maunalua's partners include the Polynesian Voyaging Society, Hui Nalu, and Malama Hawaii.

5.0 PROJECT MONITORING AND EVALUATION

5.1 Design

Generally, the project monitoring and evaluation protocol would be designed to both periodically assess and adapt project implementation progress, as well as document and measure biological and socioeconomic changes associated with the project's impact at the Kuli‘ou‘ou site, at the community removal areas, and throughout participating neighborhoods in the Bay. Fifteen project impact indicators (see Appendix B) would be measured throughout the 18-month project lifetime, including before and after completion of project activities associated with IAA removal, job creation, and community outreach, involvement, and capacity-building. Measurements before and after IAA extraction activities will be compared with control site measurements adjacent to, but outside the project site and community removal areas.

5.2 Biological Impact Indicators

The implementation team would measure the biological impact of the proposed project on a monthly basis throughout the project lifetime, starting immediately upon notification of successful award receipt. Eight biological indicator measures would be used to measure the project's biological impact and observed ecological change within the project site, including the number of acres and weight of IAA biomass cleared, re-growth rates of native and invasive species into cleared areas, the number of acres of seagrass re-connected to open sandy areas, the number of total seagrass acres maintained and enhanced, the amount, diversity and distribution of native species into cleared areas, recolonization per unit area, and changes to habitat complexity and structure (via high resolution imagery). A list of all eight biological indicators to be measured is included within Appendix B.

Field measurement of reef and seagrass habitat and associated organisms via replicated stratified random quadrat sampling across and adjacent to the project site would follow international coral reef monitoring standards and established field method guidelines (e.g., English *et al.* 1997, AIMS Survey Manual for Tropical Marine Resources, 2nd Edition). Data collected would not only document the biological impact of IAA removal, but also inform future removal efforts and improve project understanding of re-colonization rates by native and non-native species.

Re-colonization of native species

As a logical complement of the removal and monitoring efforts, this project provides a tremendous built-in opportunity to observe and document re-colonization (or not) by native species into the cleared areas. Having measurements of re-colonization *in-situ* under natural conditions would provide us with valuable information on the efficacy of our restoration efforts. We currently do not know if active restoration through out-planting of native species and other interventions such as herbivore releases (sea urchins) is the same, better, or worse than passive, natural recruitment. Would the extra effort of outplanting payoff or would natural predation of the native species negate and waste our efforts? Could it be that "daylighting" or exposing the original substrate through our removal efforts is sufficient to give the native species a chance to reclaim their habitats on their own at the same rate as with active replanting of native species? To answer these questions, we will establish multiple small test plots inside the cleared areas as well as outside (for controls) and stratify the experimental design by depth. Treatments would entail the out-planting of native species in ($2x2m^2$) areas. Through this monitoring, we could help add to the body of knowledge on what is necessary to have full habitat restoration and hopefully inform future restoration efforts.

Aerial flyover of the project area would be conducted quarterly by a contractor to capture ultra-high resolution (2cm x 2cm) digital and orthorectified photographs of the project area. These data would provide a powerful record of biological impact and would demonstrate the restoration progress achieved over time by the project. Sandy bottom and hard coral substrate cleared of IAA would sharply juxtapose against surrounding uncleared areas of IAA. These images and innovative monitoring method would also be used to inspire other community-based IAA removal efforts in the islands. Measurements of the area cleared as well as ground-truthed validation of the different habitat types (hard vs soft) exposed will be used to quantify the potential area that can be restored via natural recruitment of seagrass and native algae and/or coral.

5.3 Applied research /contract science

As stated in Section 2.6 of the project narrative, a Scientific Advisory Team would be created as a key component of the Project Advisory Board, in order to provide informed and sound technical advice to the Project Manager and Co-Manager. The Scientific Advisory Team would also offer scientific expertise to the project team regarding project field operations, including contributing at certain times toward impact monitoring efforts (See Section 5) and measuring IAA removal effectiveness. This team would also review the impacts of the removal and disposal efforts throughout the life of the project, advise the project manager and Project Advisory Board of any environmental issues that may arise, and monitor the state of the marine habitat as acreage is cleared and guide the measurement. Along with the Project Manager, the Scientific Advisory Team would be comprised of two TNC scientists, a representative from Mālama Maunalua, two researchers from academia, and one independent researcher.

A core component and function of the Scientific Advisory Team would be to identify and prioritize critical applied research questions relating to the proposed project. These questions would be identified and prioritized by the Scientific Advisory Team in coordination with and approval by the larger Project Advisory Board. Such critical applied research questions (identified to date) could include:

(1) What is the relative recovery performance rate and effectiveness of areas of cleared reef that are left alone to naturally recruit native organisms compared to areas of cleared reef that have native organisms (e.g., endemic algae, native sea urchins) actively reintroduced into such areas?

(2) What, if any, edge effects on community composition result from habitat fragmentation can be observed from cleared areas? Do such fragmentation effects change as the total area of cleared habitat increases? Is there an aerial threshold beyond which edge effects on community function are minimal?

(3) What is the nutrient and heavy metal composition of sediment layer trapped by alien algae strata in the Bay? What is the average volume of trapped sediment throughout the Bay? How does this vary across areas adjacent to versus away from stream mouths and outfalls?

(4) What, if any, is the re-growth rate of invasive algae from cleared reef areas? What is the recruitment rate of native and invasive species into cleared reef areas? What is the rate of natural succession of an area of reef following clearing?

(5) What is the community composition of native and invasive flora and fauna that live within the invasive algae strata and sub-strata? What is the relative contribution of other invasive epiphytic marine plants that recruit onto the invasive algae strata?

Once a set of priority applied research questions are identified by the Scientific Advisory Team and approved by the Project Advisory Board (during the first month of the project), a RFP for a qualified technical research contractor will be announced to serve as an independent, objective scientific investigation team to address the priority research questions. Once selected, this applied science contractor will report directly to the Scientific Advisory Team, with oversight by the Project Manager and Co-Manager. Results from applied science research questions will be provided during the first year of the project. These results will be used to adaptively manage all relative aspects of the project activities. Such objective and independent research will not only provide increased understanding, integrity, and adaptability to current and future IAA extraction

efforts, but also will offer the project a transparent, low-cost, high-value, and high-visibility source of project review and evaluation efforts to assist guide efforts throughout the 14-month project timeperiod, thereby minimizing potential risks and maximizing desired impacts. The applied science contract would also provide the necessary research findings and technical expertise to support informed continuity of IAA removal efforts and community capacity building efforts beyond the life of the proposed project. TNC strongly believes that to proceed with the proposed project that excluded such independent applied research would not only limit the effectiveness and potential risks associated with the project, but also seriously call into question the ecological value of the IAA removal methods proposed, thereby limiting both future application of such a strategy and potential attraction of private investment to sustain project efforts under a for-profit business model beyond the project lifetime.

5.4 Socioeconomic Impact Indicators

The removal of the IAA, while a critical first step, is not in and of itself the goal. The goal is long term marine resource restoration, which is dependent on community support. It has been repeatedly demonstrated, here and elsewhere that, because of the "public" nature of marine resources, the local community must be supportive of conservation if it is to be sustained. Public support is achieved in large measure through education, which in turn creates 1) Behavior change and 2) Support of management efforts. In addition, it has been clearly demonstrated elsewhere that the best stewards of the nearshore waters are those who live in or use that watershed. Therefore, the outreach part of this proposal purports to target Maunalua residents and Maunalua fishers to achieve a greater understanding of the threats and remedies to our Bay. Measures of success in engaging the community will include:

1. Publicity
2. Personal Contact
3. Volunteer participation
4. Changes in behavior
5. Support of government's efforts to manage
6. Continued and increased partnerships.

To the degree that these changes occur, we will have moved closer to a sustainable future.

The implementation team will measure the social and economic impact of the proposed project at two stages during the project timeline: immediately prior to project implementation (month 1), and immediately prior to completion of the IAA extraction contract (month 14). Because there are distinct economic and social attributes associated with the intended project impact, two sets of indicators will be measured during these two periods: 1) a set of 2 economic indicators, and; 2) a set of 7 socio-cultural indicators (see Attachment B). Methods of measurement for both sets of indicators would follow the international standards set forth under the IUCN/GCRMN "Socioeconomic Manual for Coral Reef Management" (Bunce et al. 2000), including both individual and focus group survey instruments. In addition, all nine socioeconomic indicators measured would track against and follow guidance outlined under "SEM-Pasifika: Socioeconomic Monitoring Guidelines for Coastal Managers in Pacific Island Countries" (Wongbusarakum and Pomeroy 2008).

The two economic indicators identified from the SEM- Pasifika "Coastal and Marine Activities" indicator category would measure the project's economic impact relating to job creation and economic stimulus within Maunalua Bay (see Appendix B). Another seven relevant socio-cultural indicators have been identified from the SEM-Pasifika "Coastal and Marine Activities", "Threats", "Management", and "Stakeholder" indicator categories, and would measure the project's social impact relating to observed socio-cultural changes within Maunalua Bay, including local management conditions (see list in Appendix B).
TNC staff will lead socioeconomic monitoring efforts in conjunction with MM staff. At the time of proposal writing, TNC is currently in the process of designing and deploying socioeconomic monitoring capabilities and efforts across all supported TNC community sites (including Maunalua Bay) as part of TNC's internal biological and socioeconmic monitoring of project effectiveness, and independent of the proposal. TNC is committed to working with local non-government and agency partners in deploying socioeconomic monitoring, as part of TNC's strategy to build local management capacity on-site and within resident communities. MM has expressed both the interest and commitment to working with TNC staff on socioeconomic

monitoring efforts within the proposed project, not only to adequately capture and measure the social impacts associated with the project, but also in order to build MM's and the local community's own capacity to undertake such monitoring efforts independent of TNC in the future. Therefore, the proposed socioeconomic monitoring activity under the project will not only serve project evaluation and adaptation purposes, but also local capacity building.

Should the proposal be selected as an awardee, TNC would be very interested to communicate and coordinate with NOAA CRP regarding the feasibility and utility of designing and coordinating on a sub-set of socioeconomic measures and methods, as appropriate, that could be selected and commonly measured across willing and interested CRP awardees (including TNC Hawaii) for trans-national and cross-site impact evaluation purposes. Not only would such shared measures and methods allow for comparability and roll-up of cumulative social impacts across awardee sites selected by NOAA, but also test, refine, and hone socioeconomic monitoring and evaluation methods led by NOAA for future application and reference within other NOAA awards and at supported sites. In the opinion of the proposal writing committee, the CRP RFP under the ARRA provides a unique and unprecedented opportunity for the use and addition of marine resource-related socioeconomic data at a national scale that would clearly enhance our collective understanding about habitat restoration efforts at the community level and improve marine resource manager's appreciation for the collection and analysis of such information. TNC offers and welcomes the opportunity to further explore this idea and opportunity with relevant NOAA personnel, as appropriate and warranted.

5.5 Monitoring Project Performance

The performance level of the project's progress would be monitored closely by TNC throughout the award timeframe. This will be achieved through two mechanisms. First, in coordination with the Advisory Board, the Project Manager will track progress of all implementation activities against the projected project timeline, and ensure that all activities are meeting intended progress milestones and target activity outputs. Second, monitoring performance relating to project impact (as opposed to activity progress) will be assessed through the measurement of the biological and socioeconomic indicators discussed in sections 5.2 and 5.3. Measurement and reporting on the results from these measures will occur throughout the project lifetime.

5.6 Evaluating Project Performance

Performance evaluation of the project will also be achieved through three mechanisms. First, monthly Advisory Board meetings will be used to assess activity implementation progress. Corrective action could be recommended to safeguard performance and maintain project momentum and consistent progress, or address and resolve any deficiencies. This performance evaluation would be ongoing throughout the project lifetime.

Second, a 'mid-term' evaluation of the project's performance would be completed during the 7th month of the project (i.e., at the start of the 3rd quarter). This evaluation would be overseen by the Advisory Board plus invited outside reviewers. The mid-term evaluation would be used as an opportunity for the project to present a synopsis of its progress and impact to date (based on monitoring data results; see section 5.4), invite suggestions on correcting or enhancing on project progress and impact, and address performance concerns or issues. The recommendations and results from this review would be used by the Project Advisory Board to evaluate mid-term progress and impact, and adapt or adjust implementation efforts to address any shortcomings or concerns sufficiently early-on during the implementation process to encourage steady and continued project performance.

Finally, an end-of-project evaluation would be included with the final project reporting to NOAA at the close of the project lifetime. This evaluation would be prepared by the Project Manager and reviewed by the Project Advisory Board. The evaluation would document the assessed total progress made by the project both in terms of progress and impact, based on monitoring data collected (see section 5.4). The end-of-project evaluation would also include recommendations regarding the potential for continued IAA extraction through private business ventures, and/or value-added products or services development relating to processed IAA.

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